



DEFENSE INFORMATION SYSTEMS AGENCY

P. O. BOX 4502
ARLINGTON, VIRGINIA 22204-4502

IN REPLY
REFER
TO:

Joint Interoperability Test Command (JITE)

30 Sep 10

MEMORANDUM FOR DISTRIBUTION

SUBJECT: Special Interoperability Test Certification of the Unified Capabilities Cisco 7206 Customer Edge Router (CER) with Internetwork Operating System (IOS) 12.4(22)T2

References: (a) DoD Directive 4630.05, "Interoperability and Supportability of Information Technology (IT) and National Security Systems (NSS)," 5 May 2004
(b) CJCSI 6212.01E, "Interoperability and Supportability of Information Technology and National Security Systems," 15 December 2008
(c) through (f), see Enclosure 1

1. References (a) and (b) establish the Joint Interoperability Test Command (JITC), as the responsible organization for interoperability test certification.
2. The Cisco 7206 Customer Edge Router with IOS 12.4(22)T2 hereinafter referred to as the System Under Test (SUT), meets all the critical interoperability requirements as a High Availability CER with System Quality Factors (SQF) and is certified for joint use within the Defense Information System Network (DISN). To meet this requirement the SUT must be deployed with two redundant 7206 Routers as depicted in the summary of this report. When a CER meets the High Availability CER with SQF requirements it is also certified as a Medium and Low Availability CER. When the SUT is deployed as a Low Availability CER only a single 7206 Router is required. The SUT met the interface capability requirements (CRs) and functional requirements (FRs) for a High Availability CER with SQF as set forth in reference (c). Testing was conducted using test procedures derived from reference (d). No other configurations, features, or functions, except those cited within this memorandum, are certified by JITC. This certification expires upon changes that affect interoperability, but no later than three years from the date of this memorandum.
3. This finding is based on interoperability testing conducted by JITC, review of the vendor's Letters of Compliance (LoC), and DISA Information Assurance (IA) Certification Authority (CA) approval of the IA configuration. Interoperability testing was conducted by JITC, Fort Huachuca, Arizona, from 20 April 2009 through 1 May 2009 and 29 July 2009 through 14 August 2009. Review of the vendor's LoC was completed on 13 September 2010. The DISA CA has reviewed the IA Assessment Report for the SUT, Reference (e), and based on the findings in the report has provided a positive recommendation. The acquiring agency or site will be responsible for the DoD Information Assurance Certification and Accreditation Process (DIACAP) accreditation. The JITC certifies the SUT as meeting the UCR for CER requirements. Enclosure 2 documents the test results and describes the tested network and

system configurations including specified patch releases. Enclosure 3 provides a detailed list of the interface, capability, and functional requirements.

4. The interface, CR and FR, and component status of the SUT is listed in Tables 1 and 2. The threshold Capability/Functional requirements for CERs are established by Section 5.3.2.14 of Reference (c) and were used to evaluate the interoperability of the SUT.

Table 1. SUT Interface Interoperability Status

Interface	Critical	UCR Reference	Threshold CR/FR Requirements (see note 1.)	Status	Remarks
ASLAN Interfaces					
10Base-X	No ²	5.3.2.4.2 5.3.2.14.9	1-3	Certified	The SUT met all critical CRs and FRs for the IEEE 802.3i (10BaseT) interface.
100Base-X	No ²	5.3.2.4.2 5.3.2.14.9	1-3	Certified	The SUT met all critical CRs and FRs for the IEEE 802.3u (100BaseT) interface.
1000Base-X	No	5.3.2.4.2 5.3.2.14.9	1-3	Not Tested	See note 3.
WAN Interfaces					
10Base-X	No ²	5.3.2.4.2 5.3.2.14.9	1-3	Certified	The SUT met all critical CRs and FRs for the IEEE 802.3i (10BaseT) interface with the following exception: One test result of the highest priority Queue was 11.32% variance from the assigned threshold. ⁴
100Base-X	No ²	5.3.2.4.2 5.3.2.14.9	1-3	Certified	The SUT met all critical CRs and FRs for the IEEE 802.3i (10BaseT) interface with the following exception: One test result of the highest priority Queue was 11.32% variance from the assigned threshold. ⁴
1000Base-X		5.3.2.4.2 5.3.2.14.9	1-3	Not Tested	See note 3.
DS1	No ²	5.3.2.14.9	1-3	Certified	The SUT met all critical CRs and FRs for this interface.
DS3	No ²	5.3.2.14.9	1-3	Certified	The SUT met all critical CRs and FRs for this interface.
E1	No ²	5.3.2.14.9	1-3	Not Tested	The SUT offers this interface; however, this interface was not tested. This is not a required interface for a CER, therefore there is no operational impact
Serial EIA-530	No ²	5.3.2.14.9	1-3	Certified	The SUT met all critical CRs and FRs for the EIA-530 serial interfaces. The SUT serial interface was tested and is certified up to 768 kbps.
Network Management Interfaces					
10Base-X	Yes	5.3.2.4.4	4	Certified	The SUT met all critical CRs and FRs for the IEEE 802.3i (10BaseT) interface. This was met by vendor's letter of compliance and evaluation by DISA during Spiral I pilot testing.
100Base-X	Yes	5.3.2.4.4	4	Certified	The SUT met all critical CRs and FRs for the IEEE 802.3u (100BaseT) interface. This was met by vendor's letter of compliance and evaluation by DISA during Spiral I pilot testing.

JITC Memo, JTE, Special Interoperability Test Certification of the Unified Capabilities Cisco
7206 High Availability Customer Edge Router with Internetwork Operating System (IOS)
12.4(22)T2

Table 1. SUT Interface Interoperability Status (continued)

NOTES:					
1. The CR/FR requirements are contained in Table 2. The CR/FR ID numbers represent a roll-up of UCR requirements. Enclosure 3 provides a list of more detailed requirements for a CER.					
2. The UCR states the minimum interface requirement for a CER ASLAN and WAN interface is Ethernet 10Base-T or 100Base-T.					
3. The SUT offers the Ethernet 1000BASE-X; however, it did not meet the minimum critical interoperability requirements for these interfaces. The UCR requires that a CER must support at a minimum a 10Base-T or 100BaseT Ethernet interface for both ASLAN and WAN interfaces; therefore, this discrepancy has no operational impact.					
4. The UCR Paragraph 5.3.3.4 states that each shaped CER queue can have margin of error of +/- 10 percent. This discrepancy was adjudicated by DISA on 26 July 2010 as having a minor operational impact.					
LEGEND:					
802.3i	10 Megabits Per Second Base Band over Twisted Pair	E1	European Basic Multiplex Rate (2.048 Mbps)		
802.3u	Standard for carrier sense multiple access with collision detection at 100 Megabits per Second	EIA	Electronic Industries Alliance		
ASLAN	Assured Services Local Area Network	FR	Functional Requirement		
CER	Customer Edge Router	ID	Identification		
CR	Capability Requirement	IEEE	Institute of Electrical and Electronics Engineers		
DISA	Defense Information Systems Agency	kbps	kilobits per second		
DS1	Digital Signal Level 1 (1.544 Mbps) (2.048 Mbps European)	SUT	System Under Test		
DS3	Digital Signal Level 3	UCR	Unified Capabilities Requirements		
		WAN	Wide Area Network		

Table 2. SUT Capability Requirements and Functional Requirements Status

CR/FR ID	Capability/ Function	Applicability (See note 1.)	UCR Reference	Status	Remarks
1	Customer Edge Router Requirements				
	Traffic Conditioning	Required	5.3.2.14.1	Met	The SUT met all critical CRs and FRs.
	Differentiated Services Support	Required	5.3.2.14.2	Met	The SUT met all critical CRs and FRs.
	Per Hop Behavior Support	Required	5.3.2.14.3	Met	The SUT met all critical CRs and FRs.
	Interface to the LSC/MFSS for Traffic Conditioning	Conditional	5.3.2.14.4	Not Tested	The SUT does not support this feature.
	Interface to the LSC/MFSS for Bandwidth Allocation	Conditional	5.3.2.14.5	Not Tested	The SUT does not support this feature.
	Network Management	Required	5.3.2.14.6	Met	The SUT met all critical CRs and FRs. This was met by vendor's letter of compliance and evaluation by DISA during Spiral I pilot testing.
	Availability	Required	5.3.2.14.7	Met	The SUT met all critical CRs and FRs. The SUT met High Availability and Medium Availability with SQF CER requirements (See note 2.)
	Packet Transit Time	Required	5.3.2.14.8	Partially Met	Met with the following minor discrepancies: The SUT did not meet the minimum Packet Transit Times per the UCR. (See note 3.)
	CER Interfaces and Throughput Support	Required	5.3.2.14.9	Met (See Note 4)	The SUT met all critical CRs and FRs with following interfaces: ASLAN: IEEE 802.3i (10BaseT) and 802.3u (100BaseT), WAN: IEEE 802.3i (10BaseT) and 802.3u (100BaseT).

Table 2. SUT Capability Requirements and Functional Requirements Status (continued)

CR/FR ID	Capability/ Function	Applicability (See note 1.)	UCR Reference	Status	Remarks
2	General Network Requirements				
	General Network Requirements	Required	5.3.3.3	Met	The SUT met all critical CRs and FRs.
	VVoIP latency	Required	5.3.3.4	Met	The SUT met all critical CRs and FRs
	Jitter	Required	5.3.3.5	Met	The SUT met all critical CRs and FRs.
	VVoIP Packet Loss	Required	5.3.3.6	Met	The SUT met all critical CRs and FRs.
	Internet Protocol Version 6	Required	5.3.3.7	Partially Met	SUT met all critical CRs and FRs. This requirement was met with a vendor's submission of a letter of compliance with the following stipulated exceptions: (See note 5.)
	System-Level Quality Factors	Required	5.3.3.9	Met	The SUT met all critical CRs and FRs. (See note 2.)
	Design and Construction	Required	5.3.3.10	Not Tested	This requirement is an operational requirement and was not tested.
	Interchangeability	Required	5.3.3.12	Met	The SUT met this requirement with Static Routing, BGP-4, and OSPF V4
	Voice Grade of Service	Required	5.3.3.13	Not Tested	This requirement is an operational deployment requirement and was not tested.
	Voice Service Quality	Required	5.3.3.15	Met	
3	IPv6 Requirements				
	Product Requirements	Required	5.3.5.4	Partially Met	(See note 5.)
4	NM Requirements				
	VVoIP NMS Interface Requirements	Required	5.3.2.4.4	Met	SUT met all critical CRs and FRs for the IEEE 802.3i (10BaseT) and 802.3u (100BaseT) interfaces. This was met by vendor's letter of compliance and evaluation by DISA during Spiral I pilot testing.
	General Management requirements	Required	5.3.2.17.2	Met	SUT met all critical CRs and FRs for the IEEE 802.3i (10BaseT) and 802.3u (100BaseT) interfaces. This was met by vendor's letter of compliance and evaluation by DISA during Spiral I pilot testing.
	Requirement for FCAPS Management	Required	5.3.2.17.3	Met	SUT met all critical CRs and FRs for the IEEE 802.3i (10BaseT) and 802.3u (100BaseT) interfaces. This was met by vendor's letter of compliance and evaluation by DISA during Spiral I pilot testing.
	NM requirements of Appliance Functions	Required	5.3.2.18	Met	SUT met all critical CRs and FRs for the IEEE 802.3i (10BaseT) and 802.3u (100BaseT) interfaces. This was met by vendor's letter of compliance and evaluation by DISA during Spiral I pilot testing.

Table 2. SUT Capability Requirements and Functional Requirements Status (continued)

NOTES:			
1. Annotation of 'required' refers to high-level requirement category. Applicability of each sub-requirement is provided in Enclosure 3.			
2. This requirement was met by testing and vendors submission of a letter of compliance. To meet the High and Medium Availability requirements with SQF, the SUT must be deployed with two redundant 7206 Routers and any two Layer 3 ASLAN components listed on the UC APL as depicted in Enclosure 2. The SUT met the Low Availability requirements with a single 7206 Router.			
3. The minimum allowed packet transit times allowed for T1, T3 and Serial for Voice and Video is as follows: T1 (Voice/Video: 10ms), T3 (Voice/Video: 6ms) and Serial (Voice/Video: not defined). The SUT actual measured Packet Transit Times were: T1 (Voice: 12ms, Video: 27ms), T3 (Voice: 4ms, Video: 22ms, Serial (Voice: 21 ms, Video 58ms). These results were adjudicated by DISA on 26 July as having a minor operational impact.			
4. The UCR 2008, Change 1, paragraph 5.3.2.14.9 states that the SUT shall support the maximum possible throughput on the WAN-side interface for a full traffic load of all traffic types sent in the ASLAN-to-WAN direction. Per DISA, a threshold of +/- 10 percent of maximum line rate is acceptable, with the intent to clarify this in the next revision of the UCR. The SUT met this threshold for all certified WAN interfaces.			
5. The SUT was not tested with IPv6, and was met solely with vendor's letter of compliance. The SUT met all IPv6 requirements for a CER with following exceptions: The SUT did not meet the following RFCs: 4303, 4305, and 4835. These discrepancies were adjudicated by DISA as having a minor operational impact based on vendors submission of a Plan of Action and Milestones by 30 April 2011.			
LEGEND:			
APL	Approved Products List	LSC	Local Session Controller
ASLAN	Assured Services Local Area Network	MFSS	Multi-Function Soft Switch
CER	Customer Edge Router	ms	milliseconds
CR	Capability Requirement	MTU	Maximum Transmission Unit
DISA	Defense Information Systems Agency	NM	Network Management
DS1	Digital Signal Level 1 (1.544 Mbps) (2.048 Mbps European)	NMS	Network Management System
DS3	Digital Signal Level 3	RFC	Request for Comment
EIA	Electronic Industries Alliance	SQF	System Quality Factors
FCAPS	Fault, Configuration, Accounting, Performance, and Security	SUT	System Under Test
FR	Functional Requirement	T1	Digital Transmission Link Level 1 (1.544 Mbps)
ID	Identification	T3	Digital Transmission Link Level 3 (45 Mbps)
IEEE	Institute of Electrical and Electronics Engineers	UC	Unified Capabilities
IPv6	Internet Protocol version 6	UCR	Unified Capabilities Requirements
kbps	kilobits per second	VVoIP	Voice and Video over Internet Protocol
		WAN	Wide Area Network

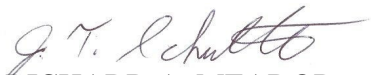
5. No detailed test report was developed in accordance with the Program Manager's request. JITC distributes interoperability information via the JITC Electronic Report Distribution (ERD) system, which uses Unclassified-But-Sensitive Internet Protocol Router Network (NIPRNet) e-mail. More comprehensive interoperability status information is available via the JITC System Tracking Program (STP). The STP is accessible by .mil/gov users on the NIPRNet at <https://stp.fhu.disa.mil>. Test reports, lessons learned, and related testing documents and references are on the JITC Joint Interoperability Tool (JIT) at <http://jit.fhu.disa.mil> (NIPRNet). Information related to DSN testing is on the Telecom Switched Services Interoperability (TSSI) website at <http://jitc.fhu.disa.mil/tssi>. Test reports, lessons learned, and related testing documents and references are on the JITC Joint Interoperability Tool (JIT) at <http://jit.fhu.disa.mil> (NIPRNet), or <http://199.208.204.125> (SIPRNet). Information related to DSN testing is on the Telecom Switched Services Interoperability (TSSI) website at <http://jitc.fhu.disa.mil/tssi>. Due to the sensitivity of the information, the Information Assurance Accreditation Package (IAAP) that contains the approved configuration and deployment guide must be requested directly through government civilian or uniformed military personnel from the Unified Capabilities Certification Office (UCCO), e-mail: ucco@disa.mil.

JITC Memo, JTE, Special Interoperability Test Certification of the Unified Capabilities Cisco 7206 High Availability Customer Edge Router with Internetwork Operating System (IOS) 12.4(22)T2

6. The JITC point of contact is Mr. Edward Mellon, DSN 879-5159, commercial (520) 538-5159, FAX DSN 879-4347, or e-mail to edward.mellon@disa.mil. The JITC's mailing address is P.O. Box 12798, Fort Huachuca, AZ 85670-2798. The Tracking Number for the SUT is 0822701.

FOR THE COMMANDER:

3 Enclosures a/s


for RICHARD A. MEADOR
Chief
Battlespace Communications Portfolio

JITC Memo, JTE, Special Interoperability Test Certification of the Unified Capabilities Cisco
7206 High Availability Customer Edge Router with Internetwork Operating System (IOS)
12.4(22)T2

Distribution (electronic mail):

Joint Staff J-6

Joint Interoperability Test Command, Liaison, TE3/JT1

Office of Chief of Naval Operations, CNO N6F2

Headquarters U.S. Air Force, Office of Warfighting Integration & CIO, AF/XCIN (A6N)

Department of the Army, Office of the Secretary of the Army, DA-OSA CIO/G-6 ASA (ALT),
SAIS-IOQ

U.S. Marine Corps MARCORSYSCOM, SIAT, MJI Division I

DOT&E, Net-Centric Systems and Naval Warfare

U.S. Coast Guard, CG-64

Defense Intelligence Agency

National Security Agency, DT

Defense Information Systems Agency, TEMC

Office of Assistant Secretary of Defense (NII)/DOD CIO

U.S. Joint Forces Command, Net-Centric Integration, Communication, and Capabilities
Division, J68

Defense Information Systems Agency, GS23

ADDITIONAL REFERENCES

- (c) Office of the Assistant Secretary of Defense, "Department of Defense Unified Capabilities Requirements 2008, Change 1," 22 January 2010
- (d) Joint Interoperability Test Command, "Unified Capabilities Test Plan (UCTP),"
- (e) Joint Interoperability Test Command, "Information Assurance (IA) Assessment of Cisco 7206 Release (Rel.) 12.4(22)T2 (Tracking Number 0822701),"

CERTIFICATION TESTING SUMMARY

- 1. SYSTEM TITLE.** The Cisco 7206 High Availability Customer Edge Router (CER) with Internetwork Operating System (IOS) 12.4(22)T2, hereinafter referred to as the System Under Test (SUT).
- 2. SPONSOR.** Defense Information Systems Agency.
- 3. PROGRAM MANAGER.** Louis Schmuckler GS15, Voice Services Engineer Branch, GS241, PO Box 4502, Arlington VA, 22204-4502, e-mail: louis.schmuckler@disa.mil.
- 4. TESTER.** Joint Interoperability Test Command (JITC), Fort Huachuca, Arizona.
- 5. SYSTEM DESCRIPTION.** The Unified Capabilities Requirements (UCR) defines a Customer Edge Router (CER) as a router located at the boundary between the Edge segment and the Access segment of the wide area network. The CER provides traffic conditioning, bandwidth management on a granular service class (i.e., voice, video) basis, and quality of service using per hop behaviors. A base/post/camp/station may have a single CER or multiple CERs based on the local architecture.

The SUT is an intelligent unified communications network border element. Perimeter routers are components used for scaling unified communications networks from being "Internet Protocol (IP) islands" within a single customer network to becoming an end-to-end IP community. The SUT uses an integrated Cisco Internetwork Operating System (IOS) application that runs on the Cisco 7206 series Integrated Services Routers (ISRs).

The SUT is a solution that provides a network-to-network demarcation interface for signaling interworking, media interworking, address and port translations, billing, security, Quality-of-Service (QoS), and bandwidth management. The SUT platform embeds voice and security functions directly inside the router.

a. SUT (High and Medium Availability with System Quality Factors (SQF)).

This solution consists of dual 7206 Routers and Catalyst 3750E switches or equivalent switches on the UC APL that are configured as a CER. If a CER meets the High Availability CER requirements with SQF, it meets all of the lesser requirements (i.e. Medium Availability with and without SQF, and Low Availability).

- **Cisco 7206 Router.** The Cisco 7206 are modular and can be configured to meet the customer's needs. They support various size installations on voice and data and should be chosen based on the client's needs. Network modules and onboard slots support Digital Signal Processors, which provide VoIP to Time Division Multiplexing conversions, conferencing, and transcoding capabilities. Cisco Routers run proprietary Cisco IOS software.

- **Cisco 3750E-24 Switch.** The Cisco Catalyst 3750 Series Stackable switches offer multilayer switching and Cisco Stack Wise technology for enterprise

branch, offices, and midsize organizations. The Catalyst 3750s or any other ASLAN layer 3 switch listed on the UC APL are required for the SUT to meet the High and Medium Availability CER requirements.

b. SUT (Low Availability).

- **Cisco 7206 Router.** The low availability system consists of only one Cisco 7206 router. The low availability configuration does not contain a second Cisco 7206 or the two Cisco Catalysts switches or equivalent switches listed on the UC APL.

6. OPERATIONAL ARCHITECTURE. Figure 2-1 depicts the DISN Unified Capabilities notional operational architecture that the SUT may be used in.

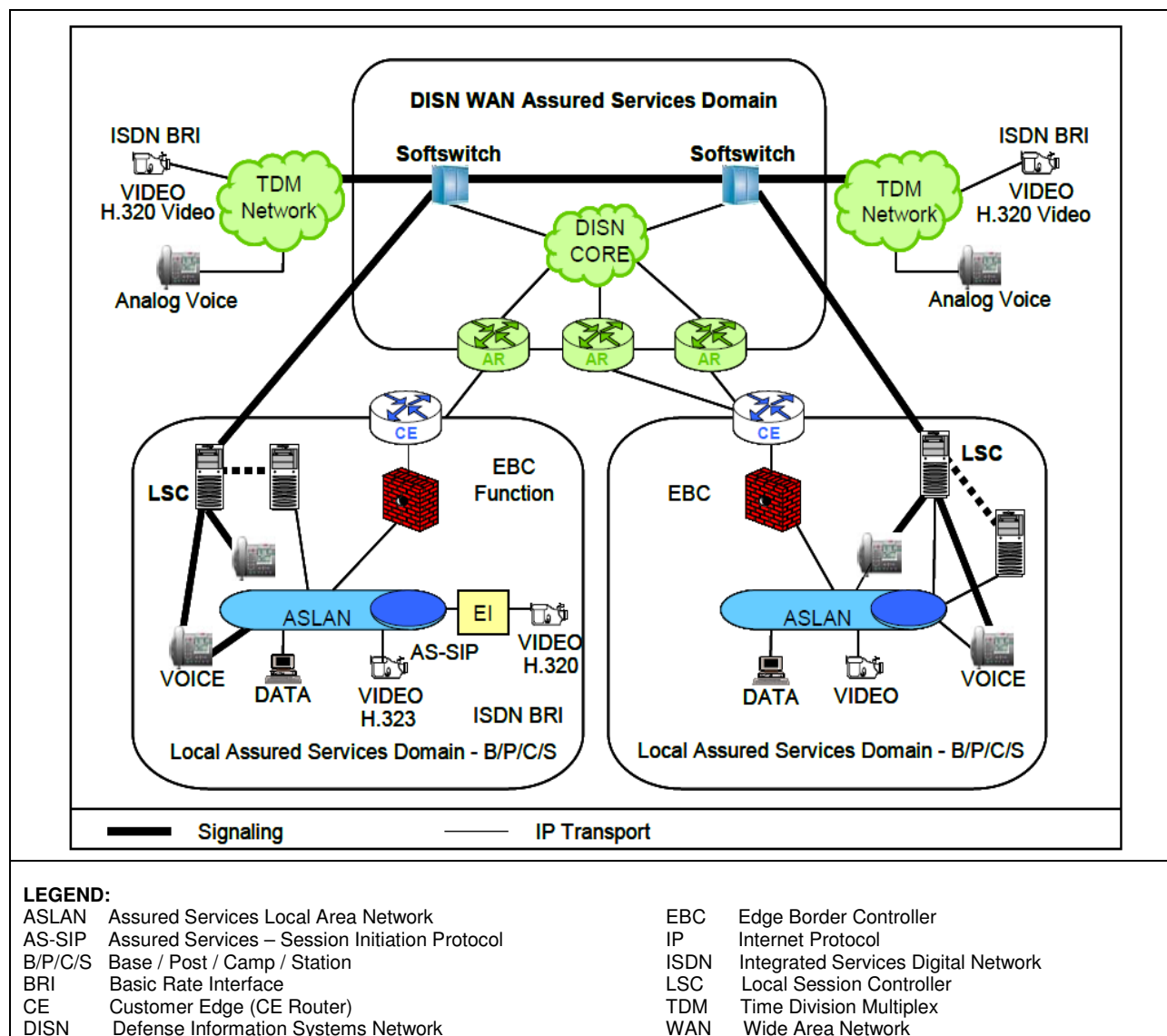


Figure 2-1. DISN Unified Capabilities Notional Operational Architecture

7. INTEROPERABILITY REQUIREMENTS. The interface, Capability Requirements (CR) and Functional Requirements (FR), Information Assurance (IA), and other requirements for customer edge routers are established by Section 5.3.2.14 of Reference (c).

7.1 Interfaces. The SUT uses the external interfaces to connect to the Global Information Grid (GIG) network. Table 2-1, shows the physical interfaces supported by the SUT. Table 2-1 also documents the physical interfaces and the associated standards.

Table 2-1. Customer Edge Router Interface Requirements

Interface	Critical	UCR Reference	Criteria (See Note 1.)
ASLAN Interfaces			
10Base-X	No ²	5.3.2.4.2 5.3.2.14.9	Support minimum threshold CRs/FRs (1-3) and meet interface criteria for IEEE 802.3i
100Base-X	No ²	5.3.2.4.2 5.3.2.14.9	Support minimum threshold CRs/FRs (1-3) and meet interface criteria for IEEE802.3u
1000Base-X	No	5.3.2.4.2 5.3.2.14.9	Support minimum threshold CRs/FRs (1-3) and meet interface criteria for IEEE 802.3z and 802.3ab
WAN Interfaces			
10Base-X	No ²	5.3.2.4.2 5.3.2.14.9	Support minimum threshold CRs/FRs (1-3) and meet interface criteria for IEEE 802.3i
100Base-X	No ²	5.3.2.4.2 5.3.2.14.9	Support minimum threshold CRs/FRs (1-3) and meet interface criteria for IEEE802.3u
1000Base-X		5.3.2.4.2 5.3.2.14.9	Support minimum threshold CRs/FRs (1-3) and meet interface criteria for IEEE 802.3z
DS1	No ²	5.3.2.14.9	Support minimum threshold CRs/FRs (1-3) and meet interface criteria for ANSI T1.102
DS3	No ²	5.3.2.14.9	Support minimum threshold CRs/FRs (1-3) and meet interface criteria for ITU-T G.703
E1	No ²	5.3.2.14.9	Support minimum threshold CRs/FRs (1-3) and meet interface criteria for ITU-T G.703
Serial EIA-530	No ²	5.3.2.14.9	Support minimum threshold CRs/FRs (1-3) and meet interface criteria for EIA 530
Network Management Interfaces			
10Base-X	Yes	5.3.2.4.4	Support minimum threshold CRs/FRs (4) and meet interface criteria for IEEE 802.3i
100Base-X	Yes	5.3.2.4.4	Support minimum threshold CRs/FRs (4) and meet interface criteria for IEEE802.3u

NOTES:

1. CR/FR requirements are contained in Table 2-2. CR/FR numbers represent a roll-up of UCR requirements. Enclosure 3 provides a list of more detailed requirements for CER products.

2. Must provide a minimum of one of the listed interfaces.

LEGEND:

802.3ab	1000BASE-T Gbit/s Ethernet over twisted pair at 1 Gbit/s	CR	Capability Requirement
802.3i	10 Megabits Per Second Base Band over Twisted Pair	FR	Functional Requirement
802.3u	Standard for carrier sense multiple access with collision detection at 100 Megabits per Second	DS1	Digital Signal 1
802.3z	1000BASE-X Gbit/s Ethernet over Fiber-Optic at 1 Gbit/s	DS3	Digital Signal 3
ANSI	American National Standard Institute	E1	European Carrier 1 (This interface was not tested)
ASLAN	Assured Services Local Area Network	EIA	Electrical Industry Association
CER	Customer Edge Router	Gbits/s	Gigabits per second
		IEEE	Institute of Electrical and Electronics Engineers
		UCR	Unified capabilities Requirements
		WAN	Wide Area Network

7.2 Capability Requirements (CR) and Functional Requirements (FR). CERs have required and conditional features and capabilities that are established by Section 5.3.2.14 of the UCR. The SUT does not need to provide non-critical (conditional) requirements. If they are provided, they must function according to the specified requirements. The SUTs features and capabilities and its aggregated requirements IAW the customer edge router requirements are listed in Table 2-2. Detailed CR/FR requirements are provided in Table 3-1 of Enclosure 3.

Table 2-2. Customer Edge Router Capability Requirements and Functional Requirements

CR/FR ID	Capability/ Function	Applicability (Note 1)	UCR Reference (Note 2)	Criteria	Remarks
1	Customer Edge Router Requirements				
	Traffic Conditioning	Required	5.3.2.14.1	Detailed requirements and associated criteria for CERs are listed in Table 3-1 of Appendix 3.	
	Differentiated Services Support	Required	5.3.2.14.2		
	Per Hop Behavior Support	Required	5.3.2.14.3		
	Interface to the LSC/MFSS for Traffic Conditioning	Conditional	5.3.2.14.4		
	Interface to the LSC/MFSS for Bandwidth Allocation	Conditional	5.3.2.14.5		
	Network Management	Required	5.3.2.14.6		
	Availability	Required	5.3.2.14.7		
	Packet Transit Time	Required	5.3.2.14.8		
	CER Interfaces and Throughput Support	Required	5.3.2.14.9		
2	General Network Requirements				
	General Network Requirements	Required	5.3.3.3	Detailed requirements and associated criteria for CERs are listed in Table 3-1 of Appendix 3.	
	VVoIP latency	Required	5.3.3.4		
	Jitter	Required	5.3.3.5		
	VVoIP Packet Loss	Required	5.3.3.6		
	Internet Protocol Version 6	Required	5.3.3.7		
	System-Level Quality Factors	Required	5.3.3.9		
	Design and Construction	Required	5.3.3.10		
	Interchangeability	Required	5.3.3.12		
	Voice Grade of Service	Required	5.3.3.13		
Voice Service Quality	Required	5.3.3.15			
3	IPv6 Requirements				
	Product Requirements	Required	5.3.5.4	See Table 3-1	
4	NM Requirements				
	VVoIP NMS Interface Requirements	Required	5.3.2.4.4	Detailed requirements and associated criteria for CERs are listed in Table 3-1 of Appendix 3.	
	General Management requirements	Required	5.3.2.17.2		
	Requirement for FCAPS Management	Required	5.3.2.17.3		
	NM requirements of Appliance Functions	Required	5.3.2.18		
NOTES: 1. Annotation of 'required' refers to high level requirement category. Applicability of each sub-requirement is provided in enclosure 3. 2. Reference document is UCR 2008 Change 1.					
LEGEND: CR Capabilities Requirement FR Functional Requirement ID Identification LSC Local Session Controller MFSS Multi-Function Soft Switch UCR Unified Capabilities Requirements					

7.3 Information Assurance. Table 2-3 details the Information Assurance (IA) requirements applicable to the CER products.

Table 2-3. CER IA Requirements

Requirement	Applicability (See note)	UCR Reference	Criteria	Remarks
General Requirements	Required	5.4.6.2	Detailed requirements and associated criteria for CER are listed in the IATP (Reference (e)).	
Authentication	Required	5.4.6.2.1		
Integrity	Required	5.4.6.2.2		
Confidentiality	Required	5.4.6.2.3		
Non-Repudiation	Required	5.4.6.2.4		
Availability	Required	5.4.6.2.5		
NOTE: Annotation of 'required' refers to high level requirement category. Applicability of each sub-requirement is provided in enclosure 3.				
LEGEND:				
CER	Customer Edge Router	IATP	IA Test Plan	
IA	Information Assurance	UCR	Unified capabilities Requirements	

7.4 Other. None

8. TEST NETWORK DESCRIPTION. The SUT was tested at Joint Interoperability Test Command (JITC), Fort Huachuca, Arizona in a manner and configuration similar to that of a notional operational environment. Testing the system's required functions and features was conducted using the test configurations depicted in Figures 2-2 and 2-3. Figure 2-2 depicts the SUT test High Availability test configuration, and Figure 2-3 depicts the SUT Low Availability test

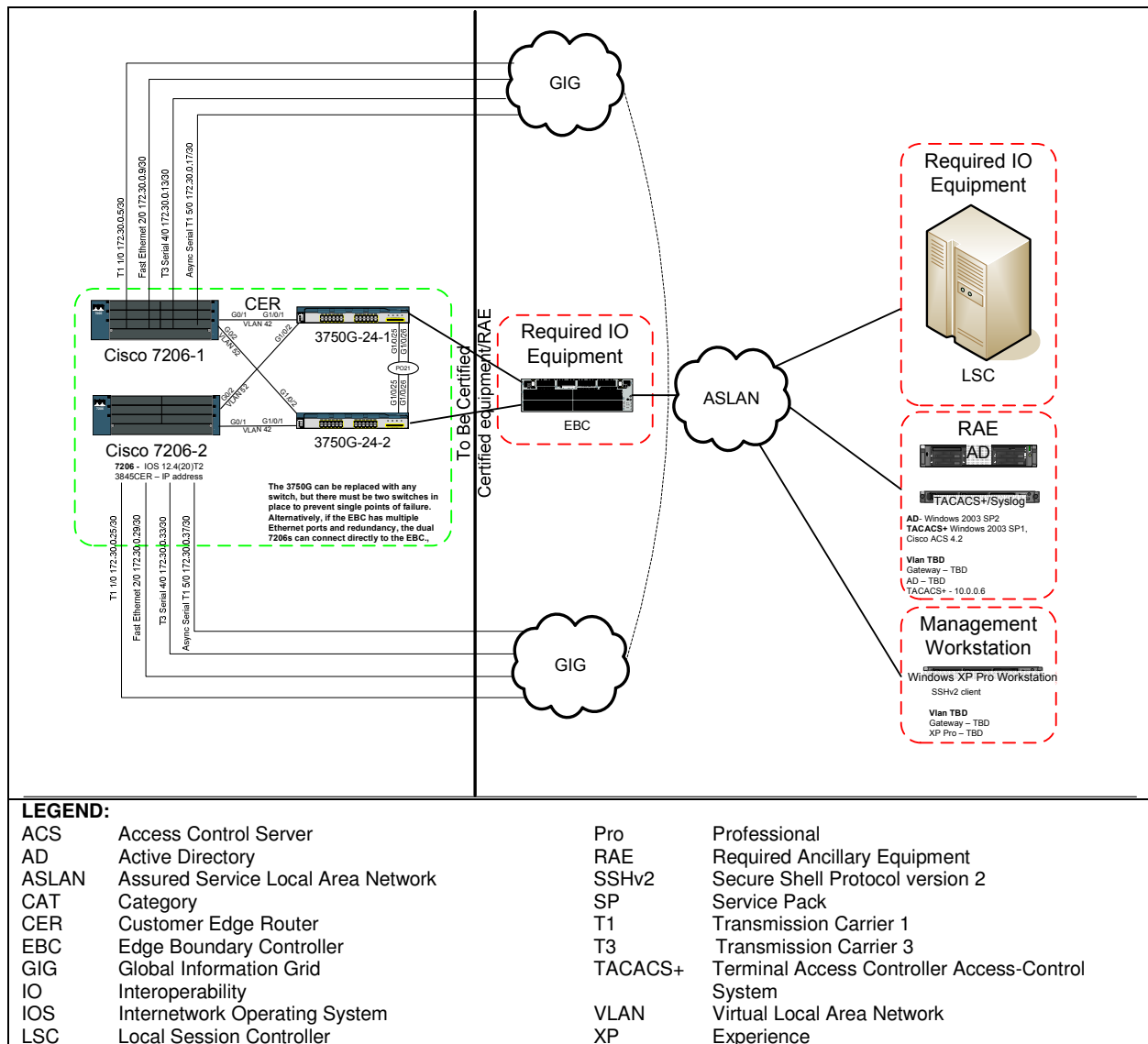


Figure 2-2. SUT High Availability Test Configuration

Table 2-3. Tested System Configurations

System Name	Equipment		
Required Ancillary Equipment	Active Directory		
	SysLog		
	Terminal Access Controller Access Control System Plus		
Cisco 7206 with IOS 12.4(20)T2 CER			
Component	Release	Sub-component	Function
Cisco 7206	IOS 12.4(22)T2	NPE-G2	7200 series NPE-G2 engine with 3 GE/FE/E ports
		PA-2T3+	2 Port T3 Serial Port Adapter Enhanced
		PA-MC-4T1	4 port multichannel T1 port adapter with integrated CSU/DSUs Modules
		PA-MC-2T1	2 port multichannel T1 port adapter with integrated CSU/DSUs
		PA-2FE-TX	2-port Fast Ethernet 100BASE-TX
Cisco Catalyst WS-C3750-24PS-E (See note 1.)	IOS Version 12.2(46)SE	NA	NA
NOTE: 1. The 3750 series was used to demonstrate redundant switches. The SUT is certified with the 3750 series switches and any other equivalent ASLAN Layer 3 component listed on the UC APL.			
LEGEND: APL Approved Product List ASLAN Assured Services Local Area Network CER Customer Edge Router CSU Channel Service Unit DSU Data Service Unit GE/FE/E Gig Ethernet/Fast Ethernet/Ethernet IOS Internetwork Operation System Mbps Megabits per Second SUT System Under Test T1 Transmission Carrier 1 (1.544 Mbps) T3 Transmission Carrier 3 (45 Mbps)			

10. TESTING LIMITATIONS. None

11. INTEROPERABILITY EVALUATION RESULTS. The SUT meets the critical interoperability requirements for a customer edge router in accordance with Section 5.3.2.14 of the UCR and is certified for joint use with other network Infrastructure Products listed on the APL. Additional discussion regarding specific testing results is located in subsequent paragraphs.

11.1 Interfaces. The interface status of the SUT is provided in Table 2-4.

Table 2-4. SUT Interface Interoperability Status

Interface	Critical	UCR Reference	Threshold CR/FR Requirements (see note 1.)	Status	Remarks
ASLAN Interfaces					
10Base-X	No ²	5.3.2.4.2 5.3.2.14.9	1-3	Certified	The SUT met all critical CRs and FRs for the IEEE 802.3i (10BaseT) interface.
100Base-X	No ²	5.3.2.4.2 5.3.2.14.9	1-3	Certified	The SUT met all critical CRs and FRs for the IEEE 802.3u (100BaseT) interface.
1000Base-X	No	5.3.2.4.2 5.3.2.14.9	1-3	Not Tested	See note 3.
WAN Interfaces					
10Base-X	No ²	5.3.2.4.2 5.3.2.14.9	1-3	Certified	The SUT met all critical CRs and FRs for the IEEE 802.3i (10BaseT) interface with the following exception: One test result of the highest priority Queue was 11.32% variance from the assigned threshold. ⁴
100Base-X	No ²	5.3.2.4.2 5.3.2.14.9	1-3	Certified	The SUT met all critical CRs and FRs for the IEEE 802.3i (10BaseT) interface with the following exception: One test result of the highest priority Queue was 11.32% variance from the assigned threshold. ⁴
1000Base-X		5.3.2.4.2 5.3.2.14.9	1-3	Not Tested	See note 3.
DS1	No ²	5.3.2.14.9	1-3	Certified	The SUT met all critical CRs and FRs for this interface.
DS3	No ²	5.3.2.14.9	1-3	Certified	The SUT met all critical CRs and FRs for this interface.
E1	No ²	5.3.2.14.9	1-3	Not Tested	The SUT offers this interface; however, this interface was not tested. This is not a required interface for a CER, therefore there is no operational impact
Serial EIA-530	No ²	5.3.2.14.9	1-3	Certified	The SUT met all critical CRs and FRs for the EIA-530 serial interfaces. The SUT serial interface was tested and is certified up to 768 kbps.
Network Management Interfaces					
10Base-X	Yes	5.3.2.4.4	4	Certified	The SUT met all critical CRs and FRs for the IEEE 802.3i (10BaseT) interface. This was met by vendor's letter of compliance and evaluation by DISA during Spiral I pilot testing.
100Base-X	Yes	5.3.2.4.4	4	Certified	The SUT met all critical CRs and FRs for the IEEE 802.3u (100BaseT) interface. This was met by vendor's letter of compliance and evaluation by DISA during Spiral I pilot testing.

Table 1. SUT Interface Interoperability Status (continued)

NOTES:			
1. The CR/FR requirements are contained in Table 2. The CR/FR ID numbers represent a roll-up of UCR requirements. Enclosure 3 provides a list of more detailed requirements for a CER.			
2. The UCR states the minimum interface requirement for a CER ASLAN and WAN interface is Ethernet 10Base-T or 100Base-T.			
3. The SUT offers the Ethernet 1000BASE-X; however, it did not meet the minimum critical interoperability requirements for these interfaces. The UCR requires that a CER must support at a minimum a 10Base-T or 100BaseT Ethernet interface for both ASLAN and WAN interfaces; therefore, this discrepancy has no operational impact.			
4. The UCR Paragraph 5.3.3.3.4 states that each shaped CER queue can have margin of error of +/- 10 percent. This discrepancy was adjudicated by DISA on 26 July 2010 as having a minor operational impact.			
LEGEND:			
802.3i	10 Megabits Per Second Base Band over Twisted Pair	E1	European Basic Multiplex Rate (2.048 Mbps)
802.3u	Standard for carrier sense multiple access with collision detection at 100 Megabits per Second	EIA	Electronic Industries Alliance
		FR	Functional Requirement
ASLAN	Assured Services Local Area Network	ID	Identification
CER	Customer Edge Router	IEEE	Institute of Electrical and Electronics Engineers
CR	Capability Requirement	kbps	kilobits per second
DISA	Defense Information Systems Agency	SUT	System Under Test
DS1	Digital Signal Level 1 (1.544 Mbps) (2.048 Mbps European)	UCR	Unified Capabilities Requirements
DS3	Digital Signal Level 3	WAN	Wide Area Network

11.2 Capability Requirements (CR) and Functional Requirements (FR). The SUT CR and FR status is depicted in Table 2-5. Detailed CR/FR requirements are provided in Enclosure 3, Table 3-1.

Table 2-5. Customer Edge Router Capability Requirements and Functional Requirements Status

CR/FR ID	Capability/ Function	Applicability (See note 1.)	UCR Reference	Status	Remarks
1	Customer Edge Router Requirements				
	Traffic Conditioning	Required	5.3.2.14.1	Met	The SUT met all critical CRs and FRs.
	Differentiated Services Support	Required	5.3.2.14.2	Met	The SUT met all critical CRs and FRs.
	Per Hop Behavior Support	Required	5.3.2.14.3	Met	The SUT met all critical CRs and FRs.
	Interface to the LSC/MFSS for Traffic Conditioning	Conditional	5.3.2.14.4	Not Tested	The SUT does not support this feature.
	Interface to the LSC/MFSS for Bandwidth Allocation	Conditional	5.3.2.14.5	Not Tested	The SUT does not support this feature.
	Network Management	Required	5.3.2.14.6	Met	The SUT met all critical CRs and FRs. This was met by vendor's letter of compliance and evaluation by DISA during Spiral I pilot testing.
	Availability	Required	5.3.2.14.7	Met	The SUT met all critical CRs and FRs. The SUT met High Availability and Medium Availability with SQF CER requirements (See note 2.)
	Packet Transit Time	Required	5.3.2.14.8	Partially Met	Met with the following minor discrepancies: The SUT did not meet the minimum Packet Transit Times per the UCR. (See note 3.)
	CER Interfaces and Throughput Support	Required	5.3.2.14.9	Met (See Note 4)	The SUT met all critical CRs and FRs with following interfaces: ASLAN: IEEE 802.3i (10BaseT) and 802.3u (100BaseT), WAN: IEEE 802.3i (10BaseT) and 802.3u (100BaseT).
2	General Network Requirements				
	General Network Requirements	Required	5.3.3.3	Met	The SUT met all critical CRs and FRs.
	VVoIP latency	Required	5.3.3.4	Met	The SUT met all critical CRs and FRs.
	Jitter	Required	5.3.3.5	Met	The SUT met all critical CRs and FRs.
	VVoIP Packet Loss	Required	5.3.3.6	Met	The SUT met all critical CRs and FRs.
	Internet Protocol Version 6	Required	5.3.3.7	Partially Met	SUT met all critical CRs and FRs. This requirement was met with a vendor's submission of a letter of compliance with the following stipulated exceptions: (See note 5.)

Table 2-5. Customer Edge Router Capability Requirements and Functional Requirements Status

CR/FR ID	Capability/ Function	Applicability (See note 1.)	UCR Reference	Status	Remarks
2	General Network Requirements (continued)				
	System-Level Quality Factors	Required	5.3.3.9	Met	The SUT met all critical CRs and FRs. (See note 2.)
	Design and Construction	Required	5.3.3.10	Not Tested	This requirement is an operational requirement and was not tested.
	Provisioning	Required	5.3.3.11	Not Tested	This requirement is an operational deployment requirement and was not tested.
	Interchangeability	Required	5.3.3.12	Met	The SUT met this requirement with Static Routing, BGP-4, and OSPF V4
	Voice Grade of Service	Required	5.3.3.13	Not Tested	This requirement is an operational deployment requirement and was not tested.
	Voice Service Quality	Required	5.3.3.15	Met	
3	IPv6 Requirements				
	Product Requirements	Required	5.3.5.4	Partially Met	(See note 5.)
4	NM Requirements				
	VVoIP NMS Interface Requirements	Required	5.3.2.4.4	Met	SUT met all critical CRs and FRs for the IEEE 802.3i (10BaseT) and 802.3u (100BaseT) interfaces. This was met by vendor's letter of compliance and evaluation by DISA during Spiral I pilot testing.
	General Management requirements	Required	5.3.2.17.2	Met	SUT met all critical CRs and FRs for the IEEE 802.3i (10BaseT) and 802.3u (100BaseT) interfaces. This was met by vendor's letter of compliance and evaluation by DISA during Spiral I pilot testing.
	Requirement for FCAPS Management	Required	5.3.2.17.3	Met	SUT met all critical CRs and FRs for the IEEE 802.3i (10BaseT) and 802.3u (100BaseT) interfaces. This was met by vendor's letter of compliance and evaluation by DISA during Spiral I pilot testing.
	NM requirements of Appliance Functions	Required	5.3.2.18	Met	SUT met all critical CRs and FRs for the IEEE 802.3i (10BaseT) and 802.3u (100BaseT) interfaces. This was met by vendor's letter of compliance and evaluation by DISA during Spiral I pilot testing.

Table 2-5. Customer Edge Router Capability Requirements and Functional Requirements Status

NOTES:

1. Annotation of 'required' refers to high-level requirement category. Applicability of each sub-requirement is provided in Enclosure 3.
2. This requirement was met by testing and vendors submission of a letter of compliance. To meet the High and Medium Availability requirements with SQF, the SUT must be deployed with two redundant 7206 Routers and any two Layer 3 ASLAN components listed on the UC APL as depicted in Enclosure 2. The SUT met the Low Availability requirements with a single 7206 Router.
3. The minimum allowed packet transit times allowed for T1, T3 and Serial for Voice and Video is as follows: T1 (Voice/Video: 10ms), T3 (Voice/Video: 6ms) and Serial (Voice/Video: not defined). The SUT actual measured Packet Transit Times were: T1 (Voice: 12ms, Video: 27ms), T3 (Voice: 4ms, Video: 22ms. Serial (Voice: 21 ms, Video 58ms). These results were adjudicated by DISA on 26 July as having a minor operational impact.
4. The UCR 2008, Change 1, paragraph 5.3.2.14.9 states that the SUT shall support the maximum possible throughput on the WAN-side interface for a full traffic load of all traffic types sent in the ASLAN-to-WAN direction. Per DISA, a threshold of +/- 10 percent of maximum line rate is acceptable, with the intent to clarify this in the next revision of the UCR. The SUT met this threshold for all certified WAN interfaces.
5. The SUT was not tested with IPv6, and was met solely with vendor's letter of compliance. The SUT met all IPv6 requirements for a CER with following exceptions: The SUT did not meet the following RFCs: 4303, 4305, and 4835. These discrepancies were adjudicated by DISA as having a minor operational impact based on vendors submission of a Plan of Action and Milestones by 30 April 2011.

LEGEND:

APL	Approved Products List	LSC	Local Session Controller
ASLAN	Assured Services Local Area Network	MFSS	Multi-Function Soft Switch
CER	Customer Edge Router	ms	milliseconds
CR	Capability Requirement	MTU	Maximum Transmission Unit
DISA	Defense Information Systems Agency	NM	Network Management
DS1	Digital Signal Level 1 (1.544 Mbps) (2.048 Mbps European)	NMS	Network Management System
DS3	Digital Signal Level 3	RFC	Request for Comment
EIA	Electronic Industries Alliance	SQF	System Quality Factors
FCAPS	Fault, Configuration, Accounting, Performance, and Security	SUT	System Under Test
FR	Functional Requirement	T1	Digital Transmission Link Level 1 (1.544 Mbps)
ID	Identification	T3	Digital Transmission Link Level 3 (45 Mbps)
IEEE	Institute of Electrical and Electronics Engineers	UC	Unified Capabilities
IPv6	Internet Protocol version 6	UCR	Unified Capabilities Requirements
kbps	kilobits per second	VVoIP	Voice and Video over Internet Protocol
		WAN	Wide Area Network

a. Customer Edge Router Requirements.

(1) Traffic Conditioning. The CER shall be capable of performing traffic conditioning (policing and shaping) on inbound and outbound traffic in accordance with (IAW) Section 5.3.1.14.1 of UCR 2008 Change 1. This may involve the dropping of excess packets or the delaying of traffic to ensure conformance with Service Level Agreements (SLAs). The SUT met this requirement for both IPv4 and IPv6 for four queues with testing and vendors letter of compliance.

(2) Differentiated Services Support. The CER shall be capable of supporting Differentiated Services (DiffServ) in accordance with request for comments (RFCs) 2475 and 2474 IAW Section 5.3.2.14.2 of UCR 2008 Change 1. The SUT met this requirement for both IPv4 and IPv6 with both testing and vendors letter of compliance.

(3) Per Hop Behavior Support. The CER shall be capable of supporting the Per Hop Behaviors (PHBs) IAW Section 5.3.2.14.3 of UCR 2008 Change 1. The CER shall be capable of supporting Expedited Forwarding (EF) PHBs in accordance with

RFC 3246 and Assured Forwarding (AF) PHB in accordance with RFC 2597. The SUT met this requirement with both testing and vendors letter of compliance.

(4) Interface to the LSC/MFSS for Traffic Conditioning. The CER shall be capable of interfacing to the Local Session Controller (LSC) or Multifunction Softswitch (MFSS) in real time to adjust traffic conditioning parameters based on the updated LSC/MFSS budgets IAW Section 5.3.2.14.4 of UCR 2008 Change 1. This is a conditional requirement. This requirement is not met by the SUT.

(5) Interface to the LSC/MFSS for Bandwidth Allocation. The CER shall be capable of interfacing to the LSC/MFSS in real time to adjust the PHB bandwidth allocations based on the updated LSC/MFSS budgets IAW Section 5.3.2.14.5 of UCR 2008 Change 1. This is a conditional requirement. This requirement is not met by the SUT.

(6) Network Management. The CER shall support fault, configuration, accounting, performance and security (FCAPS) Network Management functions as defined in the Section 5.3.2.17, Management of Network Appliances, IAW Section 5.3.2.14.6 of UCR 2008 Change 1. The SUT met this requirement with a vendors letter of compliance and testing conducted during Spiral I pilot testing.

(7) Availability. IAW Section 5.3.2.14.7 of UCR 2008 Change 1, there are four types of CE Routers: High Availability, Medium Availability without System Quality Factors (SQF), Medium Availability with SQF, and Low Availability. The High Availability CER shall have an availability of 99.999 percent, including scheduled hardware and software maintenance (non-availability of no more than 5 minutes per year). The CER shall meet the requirements specified in Section 5.3.2.5.2, Product Quality Factors, in this document. The Medium Availability CER without SQF shall have an availability of 99.99 percent, including scheduled hardware and software maintenance (non-availability of no more than 52.5 minutes per year). This CER does not need to meet the requirements specified in Section 5.3.2.5.2, Product Quality Factors. The Medium Availability CE Router with SQF shall have an availability of 99.99 percent, including scheduled hardware and software maintenance (non-availability of no more than 52.5 minutes per year). This CER shall meet the requirements specified in Section 5.3.2.5.2, Product Quality Factors. The Low Availability CE Router shall have an availability of 99.9 percent, including scheduled hardware and software maintenance (non-availability of no more than 8.76 hours per year). This CER does not need to meet the requirements specified in UCR 2008, Section 5.3.2.5.2, Product Quality Factors. The SUT met the requirements for High Availability with SQF, Medium Availability with and without SQF, and Low Availability. High Availability with SQF is met with redundant 7206 routers and redundant switches as depicted in figure 2-2. The SUT switches tested in this configuration were the Cisco Catalyst 3750E-24 with IOS Version 12.2(46)SE. The SUT is certified with these switches or any equivalent Layer 3 ASLAN component listed on the UC APL. The availability requirement of 99.999 for High Availability with SQF was met with vendors Letter of Compliance. An SUT that meets High Availability with SQF requirements

meets the lesser availability categories of CER. The Low Availability was met by the SUT with a single 7206 Router as depicted in figure 2-3.

(8) Packet Transit Time. The CER shall be capable of receiving, processing, and transmitting a voice packet within 2 milliseconds or less in addition to the serialization delay for voice packets as measured from the input interface to output interface under congested conditions (as described in UCR 2008, Section 5.3.1.4.1.1, ASLAN Voice Services Latency) to include all internal functions. The SUT measured latency was 3.5 ms for Ethernet, 4 seconds for T3, 12 ms for T1 and 21 ms for Serial WAN interfaces. These discrepancies were adjudicated by DISA on 26 July 2010 as having a minor operational impact.

(9) CER Interfaces and Throughput Support. IAW Section 5.3.2.14.9 of UCR 2008 Change 1, the CER supports an Assured Services Local Area network (ASLAN)-side connection to the Edge Boundary Controller (EBC) and a Wide Area Network (WAN)-side connection to the DISN WAN. The ASLAN-side interface shall be an Ethernet interface (10 BT or 100 BT) full duplex, and at least one of the WAN-side interfaces shall be an Ethernet interface (10 BT or 100BT) full duplex. Per DISA, a threshold of +/- 10 percent of maximum line rate is acceptable, with the intent to clarify this in the next revision of the UCR. The SUT met the throughput requirements of 90% or better for all WAN interfaces which includes: The IEEE 802.3i (10BaseT) , IEEE 802.3u (100BaseT), DS3, DS1, and Serial.

(a) The CER may conditionally support a WAN-side access connection interface which can also be TDM based (i.e., DS1, DS3, or E1). These are all full-duplex interfaces, and support two-way simultaneous information exchange at the "line rate" for the interface (i.e., 1.5 Mbps for DS1, 45 Mbps for DS3, 2.0 Mbps for E1). The SUT is certified for the following WAN interfaces: Ethernet 10BaseT and 100BaseT, DS1, DS3, and Serial EIA 530 @ 768 Kbps

(10) The CER shall support the maximum possible throughput on the WAN-side interface for a full traffic load of all traffic types sent in the ASLAN-to-WAN direction. The SUT met this requirement for all interfaces within +/- 10 percent maximum possible throughput of each WAN interface.

(11) The CER shall support the maximum possible throughput on the WAN-side interface for a full traffic load of all traffic types sent in the WAN-to-ASLAN direction. The SUT met this requirement for all interfaces within +/- 10 percent maximum possible throughput of each WAN interface.

(12) The CER shall support the maximum possible throughput on the WAN side interface in a full-duplex mode, for a full traffic load of UC packets sent simultaneously in both the ASLAN-to-WAN and WAN-to-ASLAN directions. The SUT met this requirement for all interfaces within +/- 10 percent maximum possible throughput of each WAN interface.

(13) The maximum possible throughput on the WAN-side interface shall be

the maximum line rate that the WAN-side interface is provisioned for on the CER. Per DISA, a threshold of +/- 10 percent of maximum line rate is acceptable, with the intent to clarify this in the next revision of the UCR. The IEEE 802.3i (10BaseT) interface had a measured throughput of 84.3 percent which was adjudicated by DISA on 26 July 2010 as having a minor operational impact. The maximum measured throughput of the other WAN interface was: 99.1 percent for Ethernet 10/100 BaseT, 91.7 percent for serial, 96.2 percent for DS3, and 96.8 percent for DS1.

b. General Network Requirements.

(1) General Network Requirements. The CER shall support the network requirements IAW Section 5.3.3.3 of UCR 2008 Change 1 specified below:

(a) Compression. The CER may conditionally support compression IAW Section 5.3.3.3.1 of UCR 2008 Change 1. This conditional requirement is not met by the SUT.

(b) The CER shall support the Differentiated Services Code Points (DSCP) plan shown in Table 5.3.3-1. This requirement was met by the SUT with testing and vendors letter of compliance.

(c) The CER shall support the four-queue PHBs, as defined in Table 5.3.3-2, Four-Queue PHB Approach. This requirement was met by the SUT with testing and vendors letter of compliance.

(d) The CER may conditionally support the eight-queue PHBs as defined in Table 5.3.3-3, Eight-Queue PHB Approach IAW Section 5.3.3.3. This conditional requirement was not tested.

(e) All CER's interfaces shall support traffic conditioning on an aggregate granular service class basis on the input interface IAW Section 5.3.3.3.4 of UCR 2008 Change 1. The CER shall be able to traffic condition using IP addresses, VLAN tags, protocol port numbers, and DSCPs as discriminators, as a minimum. This requirement was partially met through testing and vendors letter of compliance with the following exception: The SUT met granular service class basis for all WAN interfaces within +/- 10 percent of the shaped queue for all WAN interfaces except Ethernet (10/100BaseT) interface which measured one test result of the highest priority Queue with a 11.32% variance from the assigned threshold. This discrepancy was adjudicated by DISA on 26 July 2010 as having a minor operational impact.

(f) All CER shall support traffic conditioning on a granular service class basis on the output interface. This requirement was partially met through testing and vendors letter of compliance with the following exception: The SUT met granular service class basis for all WAN interfaces within +/- 10 percent of the shaped queue for all WAN interfaces except Ethernet (10/100BaseT) interface which measured one test result of the highest priority Queue with a 11.32% variance from the assigned threshold. This

discrepancy was adjudicated by DISA on 26 July 2010 as having a minor operational impact.

(2) VVoIP latency. All CERs shall be capable of receiving, processing, and transmitting a voice packet within 2 ms or less in addition to the serialization delay for voice packets as measured from the input interface to output interface under congested conditions IAW Section 5.3.3.4 of UCR 2008 Change 1. The SUT measured latency was 2 ms for Ethernet, 4 seconds for T3, 12 ms for T1 and 21 ms for Serial. These discrepancies were adjudicated by DISA on 26 July 2010 as having a minor operational impact.

(3) Jitter. The CE Segment supporting VVoIP shall ensure that the one-way jitter between the handset and CE Router within the Edge Segment does not exceed 3 ms (or 5 ms if the CE Router is collocated with an AR) for VVoIP sessions during any 5-minute period IAW Section 5.3.3.5.4 of UCR 2008 Change 1. The following jitter measurement were recorded by the SUT: 0 ms for Ethernet, 1.7 ms for DS1, 0 ms for DS3, and 8 ms for serial.

(4) VVoIP Packet Loss. The CE Segment supporting VVoIP shall ensure that the one-way packet loss between the handset and CE Router does not exceed 0.05 percent for VVoIP sessions as averaged over any 5-minute period 5.3.3.5.4 of UCR 2008 Change 1. The SUT measure no packet loss for all WAN interfaces which meets this requirement.

(5) Internet Protocol Version 6. The network infrastructure products supporting VVoIP shall accept, route, and process IPv6 protocol traffic while providing parity to IPv4 IAW Section 5.3.3.7 of UCR 2008 Change 1. The IPv6 requirements are found in Section 5.3.5, IPv6 Requirements. The SUT was not tested with IPv6, and was met solely with vendor's letter of compliance. The SUT met all IPv6 requirements for a CER with following exceptions: The SUT did not meet the following RFCs: 4303, 4305, and 4835. These discrepancies were adjudicated by DISA as having a minor operational impact based on vendors submission of a Plan of Action and Milestones by 30 April 2011.

(6) System-Level Quality Factors. The CER shall met the following System-Level Quality Factors (SQFs):

(a) The E2E network infrastructure supporting VVoIP users with precedence above ROUTINE shall have no single point of failure to include power sources and NM.

(b) E2E network infrastructure products supporting VVoIP users with precedence above ROUTINE shall support a protocol that allows for dynamic rerouting of IP packets to eliminate any single points of failure in the network IAW Section 5.3.3.9.3 of UCR 2008 Change 1. The SUT met this requirement with BGP and OSPF dynamic routing protocols.

(c) All network infrastructure products supporting VVoIP users with precedence above ROUTINE used to meet the reliability requirements shall be capable of handling the entire session processing load in the event that its counterpart product fails.

(d) All network infrastructure products supporting VVoIP that implement Multiprotocol Label Switching (MPLS) shall have a Fast Re-Route (FRR) capability that restores paths around a local failure (i.e., a failure involving a single router or circuit) within 50 ms. The MPLS protocol was not tested.

High Availability with SQF is met by the SUT with redundant 7206 routers and redundant switches as depicted in figure 2-2. The SUT switches tested in this configuration were the Cisco Catalyst 3750E-24 with IOS Version 12.2(46)SE. The SUT is certified with these switches or any equivalent Layer 3 ASLAN component listed on the UC APL. The availability requirement of 99.999 for High Availability with SQF was met with vendors Letter of Compliance.

(7) Design and Construction. The CER shall meet design and construction requirements of Section 5.3.3.10 of UCR 2008 Change 1:

(a) All F-F network infrastructure network connections supporting VVoIP shall have a bandwidth of T1 (1.544 Mbps) or greater. The SUT certified interfaces meets this requirement.

(b) The E2E network infrastructure (excluding session originators) supporting VVoIP sessions shall use the media default Maximum Transmission Unit (MTU). The media default MTU for Ethernet is 1500 bytes. This is an E2E requirement which can not be measured in a lab environment.

(c) The E2E network infrastructure supporting VVoIP sessions shall permit packet fragmentation. This is an E2E requirement which can not be measured in a lab environment.

(d) All E2E network infrastructure network connections consisting of Ethernet connections that support VVoIP shall be switched full-duplex connections. This is an E2E requirement which can not be measured in a lab environment.

(e) All E2E network infrastructure product Ethernet interfaces shall support auto-negotiation as described in the IEEE 802.3 series of standards.

(8) Interchangeability. The CER shall support the following interchangeability requirements IAW Section 5.3.3.12 of UCR 2008 Change 1:

(a) Static Routing; and

(b) BGP-4. The BGP-4 is a protocol for exchanging routing information between gateway hosts (each with its own router) in a network of autonomous systems and is described in RFCs 4271 and 1772; and

(c) Intermediate System-to-Intermediate System Protocol (IS-IS). The IS-IS is an OSI protocol by which intermediate systems exchange routing information. This protocol is not intended to be used as the protocol to interface to the ARs. .. It is a second method for interfacing between the CE Router and the AR and typically is associated with dual-homed Edge Segments; or

(d) The OSPF is an interior gateway protocol used to route IP packets within a routing domain. The OSPF version 2 for IPv4 is described in RFC 2328. Updates to OSPF for IPv6 are described in RFC 5340.

The SUT meets static routing, BGP-4 and OSPF v2 and v3 which was met by both testing and vendors letter of compliance.

(9) Voice Grade of Service. The CER shall meet Voice Grade of Service (GoS) IAW Section 5.3.3.13 of UCR 2008 Change 1:

(a) The E2E network infrastructure shall provide a GOS of P.00 (i.e., zero sessions out of 100 will be “blocked” during the “busy hour”) for FLASH and FLASH OVERRIDE voice and video (VVoIP only) sessions. This is also referred to as nonblocking service. This is an E2E requirement which can not be measured in a lab environment.

(b) The E2E network infrastructure shall provide a GOS of P.02 (i.e., two sessions out of 100 will be blocked during the busy hour) and P.01, respectively, during a 100 percent increase above normal precedence usage for PRIORITY and IMMEDIATE voice and video (VVoIP only) sessions at a minimum. This is an E2E requirement which can not be measured in a lab environment.

(10) Voice Service Quality. The CER shall met Voice service Quality IAW Section 5.3.3.15 of UCR 2008 Change 1:

(a) Because intelligibility of voice communications is critical to C2, the voice service quality rating, on at least 95 percent of the voice sessions, will have a MOS in accordance with the following scenarios: Fixed to Fixed – 4.0; Fixed to Deployable – 3.6; and, Deployable to Deployable – 3.2. The method used for obtaining the MOS shall be in accordance with the DoD Information Technology Standards Registry (DISR). NOTE: The current method used is the E-Model for F-F scenarios and P.862 for Deployable scenarios. The SUT met this requirement with a measure MOS of 4.36 or better.

c. IPv6 Requirements.

(1) **Product Requirements.** The CER must meet the IPv6 requirements IAW Section 5.3.5.4 defined for a router “R”. The SUT was not tested with IPv6, and was met solely with vendor’s letter of compliance. The SUT met all IPv6 requirements for a CER with following exceptions: The SUT did not meet the following RFCs: 4303, 4305, and 4835. These discrepancies were adjudicated by DISA as having a minor operational impact based on vendors submission of a Plan of Action and Milestones by 30 April 2011. These discrepancies were adjudicated by DISA as having a minor operational impact based on vendors submission of a Plan of Action and Milestones by 30 April 2011.

d. NM Requirements. IAW Sections 5.3.2.4, 5.3.2.17, and 5.3.2.18 of UCR 2008 Change 1, the CER must meet the following Network Management Requirements. Network Management requirements were met via a vendor-submitted LoC.

(a) **VVoIP NMS Interface Requirements.** IAW Section 5.3.2.4.4 of UCR 2008 Change 1, the physical interface between the DISA Voice and Video over IP (VVoIP) Element Management system (EMS) and the network components is a 10/100-Mbps Ethernet interface. The interface will work in either of the two following modes using auto-negotiation: IEEE, Ethernet Standard 802.3, 1993; or IEEE, Fast Ethernet Standard 802.3u, 1995. The SUT LoC stated compliance to both 10/100-Mbps interfaces.

(2) IAW Section 5.3.2.17.2 of UCR 2008 Change 1, the CER must meet the general management requirements. The SUT’s NM LoC stated compliance to Section 5.3.2.17.2.

(3) **Requirement for FCAPS Management.** IAW Section 5.3.2.17.3 of UCR 2008 Change 1, the EBC must meet the requirements for the five general functional areas of FCAPS. The SUT’s NM LoC stated compliance to Section 5.3.2.17.3.

(4) **NM requirements of Appliance Functions.** IAW Section 5.3.2.18 of UCR 2008 Change 1, the EBC must meet the NM requirements of Appliance Functions listed for an EBC. The SUT’s NM LoC stated compliance to Section 5.3.2.18.

11.3 Information Assurance. The IA report is published in a separate report, Reference (e).

11.4 Other. None

12. TEST AND ANALYSIS REPORT. No detailed test report was developed in accordance with the Program Manager’s request. JITC distributes interoperability information via the JITC Electronic Report Distribution (ERD) system, which uses Unclassified-But-Sensitive Internet Protocol Router Network (NIPRNet) e-mail. More comprehensive interoperability status information is available via the JITC System 2-7 Tracking Program (STP). The STP is accessible by .mil/gov users on the NIPRNet at <https://stp.fhu.disa.mil>. Test reports, lessons learned, and related testing documents

and references are on the JITC Joint Interoperability Tool (JIT) at <http://jit.fhu.disa.mil> (NIPRNet). Information related to DSN testing is on the Telecom Switched Services Interoperability (TSSI) website at <http://jitc.fhu.disa.mil/tssi>.

SYSTEM FUNCTIONAL AND CAPABILITY REQUIREMENTS

The customer edge routers have required and conditional features and capabilities that are established by Section 5.3.2.14 of the Unified Capabilities Requirements (UCR). The System Under Test (SUT) need not provide conditional requirements. If they are provided, they must function according to the specified requirements. The detailed Functional requirements (FR) and Capability Requirements for customer edge routers are listed in Table 3-1.

Table 3-1. Customer Edge Router Capability/Functional Requirements

ID	Requirement	UCR Reference	Required (R) Conditions (C)
1	The product shall be capable of performing traffic conditioning (policing and shaping) on inbound and outbound traffic.	5.3.2.14.1	R
2	The product shall be capable of traffic conditioning the bandwidth associated with a service class.	5.3.2.14.1	R
3	The product shall be capable of supporting DiffServ in accordance with RFCs 2475 and 2474.	5.3.2.14.2	R
4	The product shall be capable of supporting the Per Hop Behaviors (PHBs), as specified in section 5.3.3, and the product shall be capable of supporting EF PHBs in accordance with RFC 3246.	5.3.2.14.3	R
5	The product shall be capable of supporting the AF PHB in accordance with RFC 2597.	5.3.2.14.3	R
6	The CE Router shall be capable of interfacing to the LSC/MFSS in real time to adjust traffic conditioning parameters based on the updated LSC/MFSS budgets.	5.3.2.14.4	C
7	The product shall be capable of interfacing to the LSC/MFSS in real time to adjust the PHB bandwidth allocations based on the updated LSC/MFSS budgets.	5.3.2.14.5	C
8	The product shall support FCAPS Network Management functions as defined in the Section 5.3.2.17, Management of Network Appliances,	5.3.2.14.6	R
9	The product shall have an availability of 99.999 percent, including scheduled hardware and software maintenance (non-availability of no more than 5 minutes per year).	5.3.2.14.7	R ¹
10	The product shall have an availability of 99.99 percent, including scheduled hardware and software maintenance (non-availability of no more than 52.5 minutes per year).	5.3.2.14.7	R ²
11	The product shall have an availability of 99.99 percent, including scheduled hardware and software maintenance (non-availability of no more than 52.5 minutes per year).	5.3.2.14.7	C ³
12	The product shall have an availability of 99.9 percent, including scheduled hardware and software maintenance (non-availability of no more than 8.76 hours per year).	5.3.2.14.7	C ⁴
13	The CE Router shall be capable of receiving, processing, and transmitting a voice packet within 2 ms or less in addition to the serialization delay for voice packets as measured from the input interface to output interface under congested conditions.	5.3.2.14.8	R
14	The ASLAN-side interface shall be an Ethernet interface (10 BT or 100 BT) full duplex, and at least one of the WAN-side interfaces shall be an Ethernet interface (10 BT or 100BT) full duplex.	5.3.2.14.9	R
15	The WAN-side access connection interface can also be TDM based (i.e., DS1, DS3, or E1). These are all full-duplex interfaces, and support two-way simultaneous information exchange at the "line rate" for the interface (i.e., 1.5 Mbps for DS1, 45 Mbps for DS3, 2.0 Mbps for E1).	5.3.2.14.9	C

Table 3-1. Customer Edge Router Capability/Functional Requirements (continued)

ID	Requirement	UCR Reference	Required (R) Conditions (C)
16	The CE Router shall support the maximum possible throughput on the WAN-side interface for a full traffic load of all traffic types sent in the ASLAN-to-WAN direction.	5.3.2.14.9	R
17	The CE Router shall support the maximum possible throughput on the WAN-side interface for a full traffic load of all traffic types sent in the WAN-to-ASLAN direction.	5.3.2.14.9	R
18	The CE Router shall support the maximum possible throughput on the WAN side interface in a full-duplex mode, for a full traffic load of UC packets sent simultaneously in both the ASLAN-to-WAN and WAN-to-ASLAN directions.	5.3.2.14.9	R
19	The maximum possible throughput on the WAN-side interface shall be the maximum line rate that the WAN-side interface is provisioned for on the CE Router.	5.3.2.14.9	R
20	The product shall support the plain text DSCP plan, as shown in Table 5.3.3-1 of UCR 2008 Change 1, (DSCP Assignments), and the DSCP assignment shall be software configurable for the full range (0-63) to support Deployable deployments that may not use the following DSCP plan.	5.3.3.3.2	R
21	The system routers supporting VVoIP shall support the four-queue PHBs, as defined in Table 5.3.3-2 of UCR 2008 Change 1, Four-Queue PHB Approach.	5.3.3.3.3	R
22	The system routers supporting VVoIP shall support the eight-queue PHBs as defined in Table 5.3.3-3 of UCR 2008 Change 1, Eight-Queue PHB Approach.	5.3.3.3.3	C
23	All CE Router and/or AR interfaces toward the CE Router shall support traffic conditioning on an aggregate granular service class basis on the input interface.	5.3.3.3.4	R
24	The system routers shall be able to traffic condition using IP addresses, VLAN tags, protocol port numbers, and DSCPs as discriminators, as a minimum.	5.3.3.3.4	R
25	All CE Routers and/or AR interfaces toward the CE Router shall support traffic conditioning on a granular service class basis on the output interface.	5.3.3.3.4	R
26	All routers shall be capable of receiving, processing, and transmitting a voice packet within 2 ms or less in addition to the serialization delay for voice packets as measured from the input interface to output interface under congested conditions.	5.3.3.4	R
27	The CE Segment supporting VVoIP shall ensure that the one-way latency from the IP handset to the CE Router within the CE Segment is less than or equal to 35 ms (or less than or equal to 44 ms if the CE Router is collocated with an AR) for VVoIP sessions as averaged over any 5-minute period.	5.3.3.4.2	R
28	The CE Segment supporting VVoIP shall ensure that the one-way latency from the CE Router to the IP handset within the CE Segment is less than or equal to 35 ms (or less than or equal to 44 ms if the CE Router is collocated with an AR) for VVoIP sessions as averaged over any 5-minute or period.	5.3.3.4.2	R
29	The DISN Network Infrastructure supporting VVoIP shall ensure that the one-way latency from the CE Router to the CE Router across the DISN Network Infrastructure for F-F nodes does not exceed 150 ms (or 132 ms if the CE Router is collocated with an AR) for VVoIP as averaged over any 5-minute period.	5.3.3.4.4	R
30	The DISN Network Infrastructure Product supporting VVoIP shall ensure that the one-way jitter from the CE Router to the CE Router across the DISN Network Infrastructure for F-F nodes does not exceed 14 (or 10 ms if the CE Router is collocated with the AR) for VVoIP sessions during any 5-minute period.	5.3.3.5.3	R
31	The CE Segment supporting VVoIP shall ensure that the one-way jitter between the handset and CE Router within the Edge Segment does not exceed 3 ms (or 5 ms if the CE Router is collocated with an AR) for VVoIP sessions during any 5-minute period.	5.3.3.5.4	R
32	The DISN Network Infrastructure supporting VVoIP shall ensure that the one-way packet loss from the CE Router to the CE Router across the DISN Network Infrastructure for F-F nodes does not exceed 0.8 percent (or 0.3 percent if the CE Routers are collocated with the ARs) for VVoIP sessions as averaged over any 5-minute period.	5.3.3.6.3	R
33	The CE Segment supporting VVoIP shall ensure that the one-way packet loss between the handset and CE Router does not exceed 0.05 percent for VVoIP sessions as averaged over any 5-minute period.	5.3.3.6.4	R

Table 3-1. Customer Edge Router Capability/Functional Requirements (continued)

ID	Requirement	UCR Reference	Required (R) Conditions (C)
34	The network infrastructure products supporting VVoIP shall accept, route, and process IPv6 protocol traffic while providing parity to IPv4.	5.3.3.7	R
35	The availability for the Network infrastructure within the F-F from CE Router to CE Router shall be 99.96 percent or greater to include scheduled maintenance.	5.3.3.9.1	R
36	The availability to include scheduled maintenance for the network infrastructure within a Customer Edge Segment, which includes ASLAN and EBC shall be 99.998 percent or greater for FO/F users, 99.996 percent or greater for I/P users, and 99.8 percent or greater for other users.	5.3.3.9.1	R
37	The customer edge router shall meet availability design factors to minimize outages and minimize the impact of outages.	5.3.3.9.2 (9)	R
38	The customer edge router shall meet minimum product quality factors.	5.3.3.9.3 (8)	R
39	All F-F network infrastructure network connections supporting VVoIP shall have a bandwidth of T1 (1.544 Mbps) or greater.	5.3.3.10.1.1	R
40	All F-F network infrastructure network connections supporting VVoIP shall have a bandwidth of T1 (1.544 Mbps) or greater.	5.3.3.10.1.2	R
41	The E2E network infrastructure supporting VVoIP sessions shall permit packet fragmentation.	5.3.3.10.1.2	R
42	If the unclassified Edge System product supporting VVoIP uses an Ethernet interface for connecting to the LAN, then its NIC MTU size shall be set to 1400 bytes. The use of the MTU as specified will allow for overhead associated with encryptors or virtual private networks (VPNs) without causing packet fragmentation.	5.3.3.10.1.2	C
43	If the classified Edge System product supporting VVoIP uses an Ethernet interface for connecting to the LAN, then its NIC MTU size shall be set to 1280 bytes. The use of the MTU as specified will allow for overhead associated with encryptors or VPNs without causing packet fragmentation.	5.3.3.10.1.2	C
44	All E2E network infrastructure network connections consisting of Ethernet connections that support VVoIP shall be switched full-duplex connections.	5.3.3.10.1.2	R
45	All E2E network infrastructure product Ethernet interfaces shall support auto-negotiation as described in the IEEE 802.3 series of standards.	5.3.3.10.1.2	R
46	All E2E network system network links consisting of Ethernet connections that support VVoIP shall not exceed IEEE recommended distances for Ethernet cabling as shown in Table 5.3.3-4 of UCR 2008 Change 1, (IEEE Recommended Distances for Ethernet Cabling).	5.3.3.10.1.2	R
47	The E2E Network Infrastructure supporting VVoIP shall assume the use of G.711 (20 ms) for calculating bandwidth budgets within the fixed network even if compressed codecs are used.	5.3.3.11	R
48	The E2E Network Infrastructure design shall provide, at a minimum, a 25 percent increase in network capacity (i.e., throughput and number of sessions) above the current employed network capacity at all tandem switches, MFSSs, MFSSs, and critical dual-homed EO switches and LSCs.	5.3.3.11	R
49	All Edge System routers supporting VVoIP shall support, as a minimum, the following routing protocols and methods: Static Routing, BGP-4, and IS-IS or OSPF.	5.3.3.12	R
50	The E2E network infrastructure shall provide a GOS of P.00 (i.e., zero sessions out of 100 will be "blocked" during the "busy hour") for FLASH and FLASH OVERRIDE voice and video (VVoIP only) sessions.	5.3.3.13	R
51	The E2E network infrastructure shall provide a GOS of P.02 (i.e., two sessions out of 100 will be blocked during the busy hour) and P.01, respectively, during a 100 percent increase above normal precedence usage for PRIORITY and IMMEDIATE voice and video (VVoIP only) sessions at a minimum.	5.3.3.13	R
52	The E2E network infrastructure supporting VVoIP shall provide a peacetime theater GOS of P.07 (i.e., seven voice sessions out of 100 will be blocked during the busy hour) or better, and an intertheater GOS of P.09 or better, as measured during normal business hours of the theaters for ROUTINE precedence voice and video (VVoIP only) sessions traversing the network from an EO or LSC EI and/or GEI.	5.3.3.13	R

Table 3-1. Customer Edge Router Capability/Functional Requirements (continued)

ID	Requirement	UCR Reference	Required (R) Conditions (C)
53	The CE Segment supporting VVoIP shall provide a GOS between the EO and any PBX users or between an LSC and its subtended LSC that do not exceed an additional blockage of P.02 for voice or video (VVoIP video only) sessions.	5.3.3.13	R
54	No more than 15 percent of the B/P/C/Ss shall be affected by an outage in the network.	5.3.3.14	R